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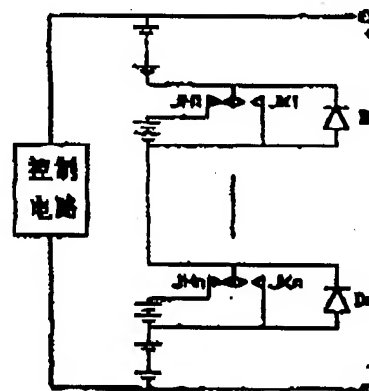
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[54] 发明名称 燃料电池组输出电压调整方法及输出电压可调燃料电池组

[57] 摘要

一种燃料电池组输出电压调整方法，其特征在于，在整个电池组中加装 1~6 个单元的备用电池，每单元备用电池包括 1~5 个单电池；当总电压低于额定值的下限时，部分或全部备用电池接入电路工作；当电池组输出电压高于额定值上限时，再切除这些备用电池。本发明易于实现，可靠性高。



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权 利 要 求 书

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1. 一种燃料电池组输出电压调整方法, 其特征在于: 采用电池组内预装备用电池的方式, 当电池的总电压低于额定值的下限时, 将部分或全部备用电池接入电池组电路, 向上调整电池组总输出电压至额定值; 当电池的总电压高于额定值的上限时, 将部分或全部备用电池切除电池组, 向下调整电池组总输出电压至额定值; 具体为:

以电池组总输出电压值为取样值, 以工作电压额定值为基准电压, 将取样值与基准电压相比较, 通过控制磁闭锁继电器线圈的导通方向, 将所述备用电池接入或切除; 即: 设取样值为 V_S , 基准电压值的上限值为 V_H , 下限值为 V_L , 当取样值 V_S 低于下限值 V_L 值时, 控制磁闭锁继电器线圈一个电流方向, 继电器公共端与接备用电池的一个触点吸合, 将所述备用电池部分或全部接入电池组电路, 向上调整电池组总输出电压至额定值; 当取样值 V_S 高于上限值 V_H 值时, 控制磁闭锁继电器线圈电流为相反方向, 继电器公共端与没接备用电池的另一个触点吸合, 将加入的所述备用电池部分或全部从电池组电路中切除, 向下调整电池组总输出电压至额定值。

2. 一种输出电压可调燃料电池组, 其特征在于: 整个电池组由额定电池通过控制电路串接 1~6 个单元备用电池构成, 每单元备用电池包括 1~5 个单电池;

控制电路由核心元件磁闭锁继电器、电压比较电路、控制驱动电路组成, 电压比较电路一个输入信号来自电池组, 另一个输入信号为基准电压, 电压比较电路的输出端经控制驱动电路与磁闭锁继电器线圈相连, 磁闭锁继电器公共端接电池组相邻单电池前一节电池的末端, 其一个触点 JH 与备用电池前端相连, 备用电池的末节接电池组相邻单电池后一节电池的前端, 磁闭锁继电器另一个触点 JK 与所述备用电池末端相连; 所述控制驱动电路主要由振荡器 1、振荡器 2 及三极管 $T1 \sim T8$ 构成桥式结构, 振荡器 1、振荡器 2 的控制输入端接电压比较电路的输出端, 其输出端分别经一组三极管接磁闭锁继电器线圈。

3. 按照权利要求 2 所述输出电压可调燃料电池组, 其特征在于: 每单元备用电池两端与二极管并联。

4. 按照权利要求 2 所述输出电压可调燃料电池组, 其特征在于: 备用电池单元数为 1~3 个, 每单元备用电池包括 2~3 个单电池。

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燃料电池组输出电压调整方法及输出电压可调燃料电池组

技术领域

本发明涉及燃料电池技术，特别提供了一种燃料电池组输出电压的调整方法及可调整输出电压的燃料电池组。

背景技术

燃料电池的动态内阻很大，过载能力有限，在长期运行过程中，电池性能还会逐渐下降。为了满足用户对电源电压的各种要求（例如：在负荷成倍变化时，工作电压要稳定在一定的范围内），必须对电池组的输出电压进行调整，国外通常采用下述几种方法：1.当电池组输出电压高于预定值时，向燃料气和/或氧化剂中加入一定量的惰性气体，或将阴极排放气部分循环回阴极供气中，以降低输出电压。2.根据负载的变化控制燃料气和氧化剂的压力和流速。3.正常负载时部分电能用于给蓄电池充电，以保证峰值负载时电压在控制范围内。4.在采用重整装置获得粗氢的系统中，根据负载的变化，控制重整反应器的反应条件和进料速度，以改变所转化的粗氢的压力、速度以及含氢量等。如文献1 Ger.Offen 2,941,514 所提供的方法是，当电池负荷降低，输出电压超过额定值时，将阴极排放气部分循环加入阴极的供气中，以降低氧分压，从而保证输出电压降到额定范围内。文献2 Jpn. Kokai Tokkyo Koho JP.59, 111, 270 的方法是将输出功率与额定功率相比较，以此控制燃料和氧化剂供气管路上的电磁阀，以调整供气压力和流速，达到控制输出功率的目的。上述方法均存在控制条件复杂，难于实施，可靠性差的特点。

发明内容

本发明的目的在于提供一种燃料电池组输出电压调整方法及输出电压可调燃料电池组，其易于实现，可靠性高。

本发明提供了一种燃料电池组输出电压调整方法。其特点在于：采用电池组内预装备用电池的方式，当电池的总电压低于额定值的下限时，将部分或全部备用电池接入电池组电路，向上调整电池组总输出电压至额定值；当电池的总电压高于额定值的上限时，将部分或全部备用电池切除电池组，向下调整电池组总输出电压至额定值；具体为：

以电池组总输出电压值为取样值，以工作电压额定值为基准电压，将取样值与基准电压相比较，通过控制磁闭锁继电器线圈的导通方向，将所述备用电池接入或切除；即：设取样值为VS，基准电压值的上限值为VH，下限值为VL，当取样值VS低于下限值VL值时，控制磁闭锁继电器线圈一个电流方向，继电器公共端与

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接备用电池的一个触点吸合,将所述备用电池部分或全部接入电池组电路,向上调整电池组总输出电压至额定值;当取样值 VS 高于上限值 VH 值时,控制磁闭锁继电器线圈电流为相反方向,继电器公共端与没接备用电池的另一个触点吸合,将加入的所述备用电池部分或全部从电池组电路中切除,向下调整电池组总输出电压至额定值。

本发明还提供了一种采用上述方法的输出电压可调燃料电池组,其特征在于:整个电池组由额定电池通过控制电路串接1~6个单元备用电池构成,每单元备用电池包括1~5个单电池;

控制电路由核心元件磁闭锁继电器、电压比较电路、控制驱动电路组成,电压比较电路一个输入信号 VS 来自电池组,另一个输入信号为基准电压,电压比较电路的输出端经控制驱动电路与磁闭锁继电器线圈相连,磁闭锁继电器公共端接电池组相邻单电池前一节电池的末端,其一个触点 JH 与备用电池前端相连,备用电池的末节接电池组相邻单电池后一节电池的前端,磁闭锁继电器另一个触点 JK 与所述备用电池末端相连;所述控制驱动电路主要由振荡器1、振荡器2及三极管 $T1$ ~ $T8$ 构成桥式结构,振荡器1、振荡器2的控制输入端接电压比较电路的输出端,其输出端分别经一组三极管接磁闭锁继电器线圈;其中:一个振荡器1的输出端接三极管 $T3$ 、 $T5$ 、 $T8$,三极管 $T8$ 输出至磁闭锁继电器的一个触点;另一个振荡器2的输出端接三极管 $T4$ 、 $T6$ ~ $T7$,三极管 $T7$ 输出至磁闭锁继电器的另一个触点;振荡器1、振荡器2的控制输入端由三极管 $T1$ 和 $T2$ 构成。

此外每备用电池组两端接二极管。其中,备用电池单元数最好为1~3个,每单元备用电池最好包括2~3单电池。

为控制燃料电池组的输出电压在预定范围内,本发明提供的技术包括如下要点:

1. 整个电池组加装备用电池,备用电池的加载以总输出电压值为指令。当总电压低于额定值的下限,部分或全部备用电池接入电路工作,使电压升高达到额定值;当电池组输出电压高于额定值的上限时,再切除这些备用电池,使之空载。
2. 备用电池单元数和每单元备用电池的单元个数,应该根据单元的性能,负载变化的范围和要求控制的精度、电池长期工作性能衰减的情况等来确定。
3. 电压调整电子线路按图1方框图设计。

备用单元的接入和切除通过控制磁闭锁继电器 $JMX-5M$ 来实现,当输出电压高于额定值时, $JMX-5M$ 向一边吸合,使触点 JK 闭合, JH 断开,备用电池不接入电池组(或从电池组切除)。当输出电压低于额定值时, $JMX-5M$ 向另一边吸合,触点 JK 断开, JH 闭合,备用电池接入电池组工作。

该电压调整系统可以同时多个单元备用电池接入或切除。当输出电压低于额定值下限时,系统指令第一单元接入,如仍不能达到要求则接入第二单元,第三单

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元,直到输出电压高于下限值;反之若输出电压高于上限值,则从已加载的最后一个单元开始切除,直至全部切除为止。

在备用电池切换过程中,即JMX-SM的触点JH、JK转换过程,通过二极管D与电池组和负载构成回路,以保证电池组的输出不发生瞬间开路。

4. 磁闭锁继电器的控制驱动电路如图2,当电池组输出电压低于控制下限时,电压比较电路输出的信号Vcon为低电平,振荡器1输出一串方波,三极管T3、T5、T8导通,电流由左端流入,从右端流出,继电器触点与JH端吸合,备用电池接入;当电池组输出电压高于控制上限时,电压比较电路输出的信号Vcon为高电平,振荡器2输出一串方波,三极管T4、T6、T7导通,电流由右端流入,从左端流出,继电器触点与JK端吸合,备用电池切除。

总之,1.本发明再输出电压控制中首次采用电池组内与装备用电池的方案,简化了控制系统。

2.所设计的电路保证了备用电池的正确切换,切换过程无瞬间开路。

3.由于本发明采用切换备用电池的方法,不需改变操作参数,电池系统可以始终工作在最佳条件下,提高了整个燃料电池组的效率。

4.采用本发明的电压调整技术,即使在输出功率大幅度变化(例如成倍增加)时,电池组的输出电压仍能控制在额定范围内,这是其他通过改变操作参数控制电压的方案所难以达到的。

5.利用脉冲串控制继电器,不仅控制可靠,而且可以节省驱动电路消耗的电能。利用三极管组成无触点的桥式倒相电路,克服了有触点开关响应时间长、寿命短、耗电大的缺点。

附图说明

下面结合附图通过实施例详述本发明。

附图1为电压调整电路方框图。

附图2为磁闭锁继电器的控制驱动电路。

附图3为电压比较电路I。

附图4为电压比较电路II。

具体实施方式

实施例1

一个由31个单电池组成的燃料电池组I,其中两个(第25、26个)为一个单元的备用电池。要求输出电压控制在 $26.5 \pm 0.15V$ 和 $29.8 \pm 0.15V$ 之间。图3为电压比较电路,电池输出电压VS经DW1、DW2降压后,由R4、R5分压后作为取样电压接入比较器的正输入端,基准电压6V经R1、R2和R3分压后接入比较器的负输入端作为比较电压。当取样电压高于比较电压时,输出电压Vcon为高电平,当取样电压低于比较电压时,输出电压Vcon为低电平。将Vcon输入图2的驱动电

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路作控制电压,即可实现备用电池的切换。

表1为燃料电池组I输出电压的实验结果。

实施例2

39个单电池组成燃料电池组II,其中四个组成两个单元的备用电池(第21、22个为第一个单元,第31、32个为第二个单元)。要求电压控制在 $26.5 \pm 0.15\text{V}$ 和 $29.8 \pm 0.15\text{V}$ 之间。

图4为电压比较电路,U4为通用双向移位寄存器,其中左移预置'1',右移预置'0',当取样电压VS低于比较电压VL时,寄存器右移置'0',当取样电压VS高于比较电压VH时,寄存器左移置'1'。Q为控制信号输出端。把Q1输出到一组继电器的驱动电路的输入端Vcon1,把Q2输出到另一组继电器的驱动电路的输入端Vcon2,实现了两个单元备用电池的切换。根据这个原理,该控制电路经适当调整可用于任一单元备用电池的切换。

表2为燃料电池组II输出电压的实验结果。

在以上两个实施例中,检测切换瞬间燃料电池组的输出电压,均未发现毫秒级的断路。环境温度在 $20 \sim 60^\circ\text{C}$ 范围内变化,电压调整的上下限变化小于 0.05V 。

表1 电池组I输出电压调整结果

累计时间 hr	电流 A	电流密度 mA/cm^2	总电压 V	工作单 池个数	备用电池单个电压	
					V25	V26
1	6.6	50	28.7	29	1.124	1.126
100	6.3	47	28.2	29	1.106	1.105
200	12.65	94	27.9	31	0.905	0.911
300	6.6	50	29.5	31	0.950	0.956
400	12.80	95	27.3	31	0.902	0.892
510	6.90	51	29.5	31	0.916	0.901
600	6.15	45	27.7	29	1.113	1.115
700	12.8	95	26.7	31	0.890	0.886
800	6.35	47	29.0	31	0.933	0.935
880	12.5	93	26.6	31	0.882	0.864
900	6.4	47	28.8	31	0.925	0.931
1000	7.6	56	28.4	31	0.931	0.925

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表2 电池组II输出电压调整结果

累计 时间 hr	电流 A	电流 密度 mA/c m ²	总电 压 V	工作 单池 个数	备用电池单个电压			
					V21	V22	V31	V32
1	10.29	76	29.50	35	1.024	1.023	1.026	1.027
100	20.71	163	27.62	35	1.022	1.021	1.020	1.028
200	40.25	298	27.23	37	0.730	0.734	1.024	1.025
300	10.34	77	29.66	35	1.024	1.021	1.029	1.027
400	48.20	357	26.68	39	0.678	0.689	0.680	0.685
500	30.39	226	26.45	35	1.023	1.028	1.026	1.021
600	20.71	153	27.55	35	1.019	1.025	1.023	1.026
700	48.17	357	26.55	39	0.681	0.685	0.679	0.689
800	40.28	298	27.03	37	0.735	0.740	1.025	1.020
900	20.78	154	27.48	35	1.028	1.019	1.025	1.027
1000	30.96	226	27.69	37	0.747	0.749	1.018	1.018
1100	40.25	298	27.10	37	0.735	0.738	1.025	1.020
1200	30.50	226	27.85	37	0.745	0.751	1.028	1.019

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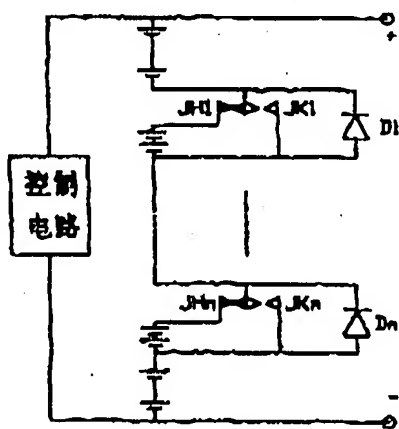


图 1

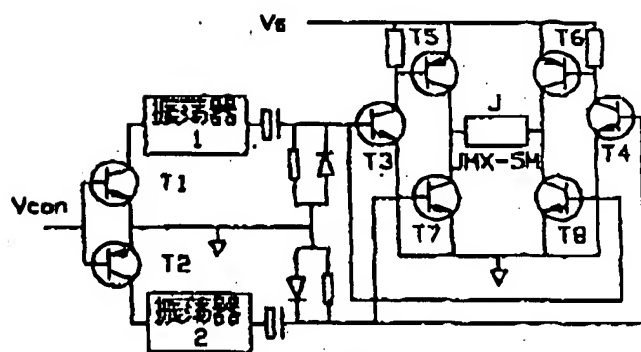


图 2

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说明书附图 第2/2页

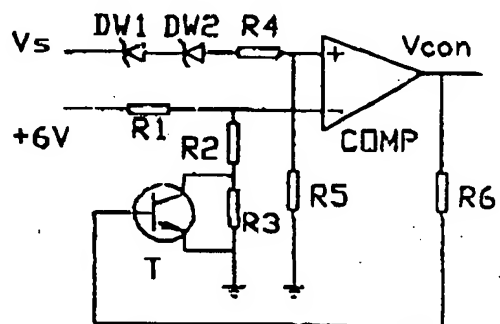


图 3

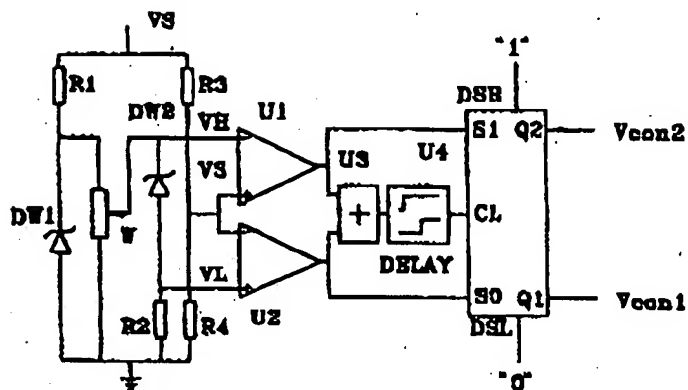


图 4

Method for modulating output voltage of fuel cell set, and fuel cell set having modulated output voltage

Publication number: CN1242615

Publication date: 2000-01-28

Inventor: YI BAOLIANG (CN); YUAN QUAN (CN); SUN DEYAO (CN)

Applicant: DALIAN CHEMICAL PHYSICS INST (CN)

Classification:


- International: H01M8/00; H01M8/24; H01M8/00; H01M8/24; (IPC1-7): H01M8/24

- European:

Application number: CN19981014176 19980722

Priority number(s): CN19981014176 19980722

Also published as:

 CN1121077C (C)

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Abstract of CN1242615

The characteristic is to fit 1-6 stand-by battery units in whole battery group, each stand-by battery unit includes 1-5 single batteries. Connection of partial or all stand-by batteries in the circuit to work when general voltage is lower than the lower limit of rated value. Cutting-off stand-by batteries when output voltage of the battery group is higher than the upper limit of rated value. The invention method is easy to be realized and has high reliability.

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THE STATE INTELLECTUAL PROPERTY OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA

APPLICATION NO.: 2005800095354	APPLICANT: AMERICAN POWER CONVERSION CORPORATION
FILING DATE: January 11, 2005	DATE OF MAIL: September 21, 2007
TITLE OF INVENTION: METHOD AND APPARATUS FOR PROVIDING UNINTERRUPTIBLE POWER	

FIRST NOTIFICATION OF OFFICE ACTION

1. ☒ IN ACCORDANCE WITH THE REQUEST FOR SUBSTANTIVE EXAMINATION BY THE APPLICANT, ACCORDING TO THE PROVISION IN PARAGRAPH 1, ARTICLE 35 OF THE CHINESE PATENT LAW, THE EXAMINATION ON THE ABOVE-CITED PATENT APPLICATION HAS BEEN MADE.
- ☐ THE STATE INTELLECTUAL PROPERTY OFFICE ITSELF HAS DECIDED TO MAKE A SUBSTANTIVE EXAMINATION ON THE ABOVE-CITED PATENT APPLICATION ON THE BASIS OF THE PROVISION IN PARAGRAPH 2, ARTICLE 35 OF THE CHINESE PATENT LAW.

2. ☒ THE APPLICANT REQUESTED TO DESIGNATE THE FILING DATE OF:

January 23, 2004 in the **US** Patent Office of as the priority date;

- ☐ THE APPLICANT FILED THE COPIES OF PRIORITY DOCUMENTS CERTIFIED BY THE AGENCY THAT ACCEPTED THE APPLICATION IN THE FOREIGN COUNTRY.

3. ☐ THE APPLICANT FILED THE AMENDMENT ON

- ☐ THE FOLLOWING AMENDED TEXT(S) IS NOT CONFORMITY WITH THE PROVISIONS OF ARTICLE 33 OF THE PRC PATENT LAW. THEREFORE, IT IS UNACCEPTABLE:

- ☐ Chinese translation of Annexes to the IPB Report.
- ☐ Chinese translation of the amendment under Article 19 of PCT.
- ☐ The amendment under Article 28 or 41 of PCT.
- ☐ The amendment under Rule 51 of the Implementing Regulations of PRC Patent Law.

THE AMENDMENT IS NOT ACCEPTED ON THE BASIS OF THE REASON IN DETAILS SHOWN BY THE ATTACHMENT SHEET.

4. ☒ THE EXAMINATION IS MADE ON THE BASIS OF THE FILING DOCUMENTS AS ORIGINALLY FILED.

- ☐ THE EXAMINATION IS MADE ON THE BASIS OF THE FOLLOWING DOCUMENTS:

THE ORIGINAL
APPLICATION DOCUMENTS

include

Chinese translation of the specification pages, claims and drawings pages submitted under the original PCT application.

Chinese translation of the claims submitted as IPR.

- ☒ THE FOLLOWING REFERENCE MATERIALS HAVE BEEN CITED IN THIS NOTIFICATION (THEIR SERIAL NUMBERS WILL BE REFERRED TO THE FOLLOWING PROCEDURE)

SERIAL NUMBER	FILE NUMBER OR TITLE OF REFERENCE MATERIAL	PUBLICATION DATE (OR FILING DATE OF A CONJOINT PATENT APPLICATION)
1	US5982682A	1999-11-9
2	US2003/0214007A1	2003-11-20
3	CN1121077C	2000-1-26

5. THE CONCLUSION OF THE EXAMINATION IS:

- ☐ In regard to the description:

- ☐ The subject matter of the present application is not accepted on the basis of article 5 of the Patent Law of

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the People's Republic of China.

- ☐ The description is not in conformity with the provision of the paragraph 3, Article 26 of the Patent Law of the People's Republic of China.
- ☐ The description is not in conformity with the provision of the Article 4 of the Implementing Regulations of the Patent Law of the People's Republic of China.
- ☐ The description is not in conformity with the provision of the Article 10 of the Implementing Regulations of the Patent Law of the People's Republic of China.
- ☒ In regard to the Claim:
- ☐ Claim does not have the novelty as stipulated in paragraph 3, Article 22 of the Chinese Patent Law of the People's Republic of China.
- ☒ Claims 1-3, 11-15 do not have the inventiveness as stipulated in paragraph 3, Article 22 of the Chinese Patent Law of the People's Republic of China.
- ☒ Claims 3, 14 are not in conformity with the provision of Paragraph 1, Article 26 of the Chinese Patent Law of the People's Republic of China.
- ☒ Claims 1 and 17, 22, 29, 40, 42, 55, 69, 72, 73, 78, 87, 95, 98 are not in conformity with the provision of Paragraph 1, Rule 31 of the Patent Law of the People's Republic of China.
- ☒ Claims 3, 3-4, 13, 16 are not in conformity with the provision of Rule 20 of the Implementing Regulations of the Chinese Patent Law.

THE EXPLANATION OF THE CONCLUSION IS GIVEN IN THE ATTACHMENT SHEET (IN THIS) ALL.

6. ON THE BASIS OF THE ABOVE CONCLUSION, IT IS CONSIDERED THAT
- ☐ the applicant should amend the application on the basis of the requirement in the attachment sheet.
- ☒ the applicant should present the reason on which the application can be accepted and amend the part that is indicated not to be in conformity with the requirement otherwise the application will be rejected.
- ☐ no subject matter in the application is allowable, the application will be rejected if the applicant does not make a full statement or fails to make a statement.
7. THE APPLICANT IS DRAWN ATTENTION TO THAT
- (1) in accordance with the provisions of Article 37 of the Chinese Patent Law, the applicant shall submit the observations within FOUR months from the date of receiving this notification. If the applicant without any justified reason, fails to reply within the time limit, the application shall be deemed to have been withdrawn.
- (2) the applicant shall make amendments to what is not in conformity with the provisions in the text of this notification. The amendment shall be furnished in duplicate. The formality of the amendment should be in conformity with the relative provisions of the Guideline for Examination.
- (3) any response and/or amendment must be mailed or hand delivered to the Receiving Department of the Patent Office in the People's Republic of China. Any documents that are not sent to the Receiving Department do not have legal force.
- (4) the applicant and/or his attorney could not go the Patent office in the People's Republic of China to meet the examiner if no appointment is made in advance.
8. THE TEXT OF THE NOTIFICATION ENCLOSES: 7 PAGE(S), ALONG WITH THE ENCLOSURE (HEREIN)
- ☒ copy of Cited references are enclosed in 41 sheets 3 copies.

EXAMINATION DEPARTMENT.

NAME OF EXAMINER LI HUILING

STAMP

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Text of the First Office Action

The present application relates to method and apparatus for providing uninterruptible power. The detailed opinions are issued as below:

1. Claim 1 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 1 claims a power supply system. D1 (US5982652A) discloses a power supply system with specific technical features as below (see Column 5 Line 16 through Column 6 Line 60, Fig. 5, 6 of D1): the system includes a chassis 102; a power input AC IN to receive input power from a power source; a power output AC OUT to provide output power to a load; at least one battery module mounted in the chassis 102 and having a battery output that provides battery power; at least one power module 104 mounted in the chassis 202 and coupled to the power input AC to receive the input power, coupled to the battery output to receive the battery power, and coupled to the power output to provide the output power from at least one of the battery power and the input power; a main intelligence module 114 (equivalent to the first controller recited in Claim 1), the MIM is coupled to the at least one power module; and a redundant intelligence module 116 substantially similar to the MIM and couple to the MIM, and coupled to the at least one power module 104; wherein the MIM 114 and the RIM 116 are configured to determine operational status (equivalent to the operational parameters recited in Claim 1) of the power supply.

The distinguishing technical feature between Claim 1 and D1 is "each of the first controller and the second controller stores a first set of parameters determined by the first controller and a second set of parameters determined by the second controller". However, it is a well-known knowledge to a person skilled in the art that making each of the first controller and the second controller store the first set of parameters determined by the first controller and the second set of parameters determined by the second, so as to expediently use the parameters of the determined power supply system hereafter. Therefore, based on D1 and in view of the well-known knowledge, the technical solution of Claim 1 is obvious to a person skilled in the art. Thus, the technical solution of Claim 1 does not possess any substantial technical feature nor present a notable progress. Claim 1 does not possess inventiveness and thereby does not comply with the prescription of Article 22(3) of Chinese Patent Law.

2. Claim 2 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 2 makes further limitation for Claim 1. D1 discloses the following technical

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features (see *Column 6 Lines 14-32 of D1*): the MIM functions as a primary controller in the power supply system and controls the output power of the power module, and the MIM and RIM are configured to allow the RIM to control the output power upon failure of the MIM. Thus, as Claim 1 does not possess inventiveness, the technical solution of Claim 2 does not possess any substantial technical feature nor present a notable progress. So, Claim 2 does not possess inventiveness and thereby does not comply with the prescription of Article 22(3) of Chinese Patent Law.

3. Claim 3 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 3 makes further limitation for Claim 2. D1 (see *Column 5 Lines 16-36*) discloses that: the at least one power module includes a plurality of power modules, and the at least one battery module includes a plurality of power modules. Thus, as Claim 2 does not possess inventiveness, the technical solution of Claim 3 does not possess any substantial technical feature nor present a notable progress and thereby does not possess inventiveness.

4. Claim 4 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 4 makes further limitation for Claim 1. D1 (*Column 6 Lines 14-32, Fig.6*) discloses the following technical features: the power supply system comprises communications bus 216, 218, coupled to the MIM 114, RIM 116 and at least one power module to provide duplex communication between the MIM and RIM; wherein the MIM is configured to function as master of the communication bus and control communications on the bus, and the RIM is configured to function as master of the communication bus upon the failure of the MIM. Thus, as Claim 1 does not possess inventiveness, the technical solution of Claim 4 does not possess any substantial technical feature nor present a notable progress and thereby does not possess inventiveness either.

5. Claim 5 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 5 makes further limitation for Claim 4. The technical problem solved by Claim 5 is storing the operational parameters of the power supply system.

D2 (US2003/0214507A1) discloses a data display system with specific technical features as below (see *Paragraphs 100-109, Fig.9 of D2*): the data display system comprises a repeater 19 (equivalent to the controller recited in the present application), the repeater 19 includes a processor 23 (equivalent to the main processor recited in Claim 5), an internal communication bus coupled to the communication bus, and a memory 27 coupled to the

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internal communication bus stores the control data; when the internal communication bus send updated control data to the memory 27, the repeater 19 sends stop signal that prevents from accessing the memory 27, so as to store the control data. Thus, D2 discloses most distinguishing technical features. The function of these technical features in D2 is identical with that in the present application, i.e., store the control data. Additionally, it is a routine approach that coupling the communication bus to the internal communication bus through the relay to prevent accessing the memory upon the memory updates data. Since the first controller and the second controller are redundant with each other, the person skilled in the art could readily understand that the first controller and the second controller could adopt same configuration. Therefore, as Claim 4 does not possess inventiveness, Claim 5 does not possess inventiveness either and thereby does not comply with the prescription of Article 22(3) of Chinese Patent Law.

6. Claims 11 and 12 are not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claims 11 and 12 respectively make further limitation for Claim 1. However, it is a common technical solution that configuring the four-quadrant power meter and the two-quadrant power meter in the power output and in the power module respectively, so as to detailed detect the output power of the power supply system and the output power of the power module. Thus, as Claim 1 does not possess inventiveness, the technical solutions of Claim 11 and 12 do not possess any substantial technical features nor present a notable progress. So, Claims 11 and 12 do not possess inventiveness and thereby do not comply with the prescription of Article 22(3) of Chinese Patent Law.

7. Claim 13 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 13 makes further limitation for Claim 1. However, it is a routine approach that coupling the output fuse to the power output and using the detection circuit coupled to the fuse and the first controller to detect the voltage of the fuse so as to ensure the safe operation of the power supply system. Thus, as Claim 1 does not possess inventiveness, Claims 11 and 12 do not possess inventiveness either and thereby does not comply with the prescription of Article 22(3) of Chinese Patent Law.

8. Claim 14 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 14 makes further limitation for Claim 1. D1 discloses the following technical features (see Column 8 Lines 19-21 of D1): the MIM and the RIM are adapted to receive the input signal from the chassis, and based on the state of the input signal, to function as

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a main controller or a redundant controller.

9. Claim 15 is not in conformity with the prescription of inventiveness according to Article 22(3) of Chinese Patent Law.

Claim 15 makes further limitation for Claim 1. The technical problem solved by the additional technical feature of Claim 15 is detecting the state of the output voltage.

D3 (CN1121077C) discloses a fuel battery of adjustable output voltage with specific technical features as below (see Page 4 Line 4 through Page 4 Line 12 of D3): the battery comprises a control circuit (equivalent to the first controller recited in Claim 15), the control circuit senses the output voltage of the battery output, and compare the output voltage with the upper and lower threshold to determine if the output voltage is within a predetermined range, i.e., detect the state of the output voltage. Thus, D3 discloses most technical features of Claim 15. In addition, the function of these technical features in D3 is identical with that in the present invention, i.e., detect the state of the output voltage. That is, D3 provides inspiration of applying the above said technical features into D1 to solve the technical problem thereof. Additionally, it is also a common technical solution in the art that storing the upper and lower threshold levels in the memory. Thus, as Claim 1 does not possess inventiveness, the technical solution of Claim 15 does not possess any substantial technical feature nor present a notable progress. So, Claim 15 does not possess inventiveness according to Article 22(3) of Chinese Patent Law.

10. Claims 1, 6-9 are not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

(1) Claim 1 (Line 3) recites "a power input to receive input power from a power source".

Since the battery also belongs to a power source, the input power includes the battery power. However, Claim 1 (Line 7) recites that "the power module is coupled to the power input to receive the power, and is coupled to the battery output to receive the battery power", which means that the input power does not include the battery power. Thus, the inconsistent disclosure of Claim 1 causes the scope of Claim 1 vague. So, the Examiner suggests the applicant amend the "a power input to receive input power from a power source" to be "an AC power input to receive AC input power from the AC power source", and amend the "input power" recited in Claim 1 to be "AC input power".

In addition, the similar defects existing in Claims 6-9 cause the scope of these claims vague. Suggest the applicant amend the "input power" and "power input" to be "AC input power" and "AC power input" respectively.

(2) The term "substantially similar to" is unclear, which cause the scope of Claim 1

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vague.

(3) Claim 1 recites (Lines 11-12) that "a first controller coupled to the at least one power module" and "a second controller coupled to the at least one power module". It is not clear that if the "at least one power module" is all the power modules contained in the power supply system, or is the at least one of the power module. Thus, the Examiner suggests the applicant amend "the at least one power module" to be "the said at least one power module". In addition, the similar defects also exist in Claims 4 and 7, which cause the scope of Claims 4 and 7 vague.

11. Claim 3 is not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

Claim 3 recites "at least one battery module includes a plurality of power modules". However, Claim 1 that Claim 3 depends on indirectly recites that the power supply system comprises "at least one battery module" and "at least one power module", which means the relationship between the battery module and the power module is coordinate, not inclusive. Thus, the different disclosure in Claim 1 and Claim 3 cause the scope of Claim 3 vague.

12. Claim 4 is not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

Claim 4 (Page 36 Line 2) recites "control communications on the bus". It is not clear if the "bus" refers to the communication bus. Thus, the scope of Claim 4 is vague.

13. Claim 5 is not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

Claim 5 recites "the first controller and the second controller include a main processor, an internal communications bus coupled to the communications bus through a relay". It is not clear if the "relay" is contained in the first and the second controller, which causes the scope of Claim 5 vague.

14. Claim 5 does not comply with the prescription of Article 26(4) of Chinese Patent Law.

Claim 5 recites that "an internal communications bus coupled to the communications bus through a relay". However, based on the disclosure of Description, the internal communications bus of the first controller and the second controller are coupled through the relay, and the internal communications bus of the first controller and the second controller are coupled to the external elements through the relay. It could not be deduced from the disclosure of Description that the communications bus is coupled to the internal communications bus through the relay. Thus, this technical feature of Claim 5 is not

2005800095354**support by Description.**

15. Claim 6 is not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

The unclear word "substantially" recited in Claim 6 causes the scope of Claim 6 vague.

16. Claim 8 is not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

(1) The word "substantially" in Claim 8 causes the scope of Claim 8 vague.

(2) Claim 8 recites that "activation of the cold start button powers on the power supply system". It is not clear that if the "cold start button powers" refers to the cold start button power of the first controller or the cold start button power of the second controller.

17. Claim 14 does not comply with the prescription of Article 26(4) of Chinese Patent Law.

Claim 14 recites "each of the first controller and the second controller are adapted to receive an input signal from the frame, and based on a state of the input signal, to function as a main controller or a redundant controller", which means that the input signal of the frame is determinative. However, based on the disclosure of Description, the state of the communication module is determined by the signal from the MIM, such that the main processor of the MIM or RIM could be used as the controller. That is, the signal from the MIM is determinative. Since the technical solution of Claim 14 is different from the disclosure of Description, and the technical solution of Claim 14 could not be deduced from the disclosure of Description, Claim 14 is not supported by Description.

18. Claims 15 and 16 are not in conformity with the prescription of Rule 20(1) of Implementing Regulations of Patent Law.

(1) The "output" recited in Claims 15, 16 (Line 2 in Claim 5, and Lines 2 and 4 in Claim 6) is unclear. In particular, it is not clear if the said output relates to the power output or the battery output.

(2) Claim 15 recites "upper and lower threshold levels derived from data contained in the memory device". It is not clear what the said data relates to. Thus, the scope of Claim 15 is vague.

19. Claim 1 and Claims 17, 32, 35, 40, 42, 56, 69, 72, 75, 78, 87, 95 and 98 do not possess unity according to Article 31(1) of Chinese Patent Law.

Since Claim 1 does not possess inventiveness, Claim 1 does not possess indispensable technical feature that contributing to the prior art. Thus, the independent Claim 1 and Claims 17, 32, 35, 40, 42, 56, 69, 72, 75, 78, 87, 95, 98 do not possess identical or corresponding indispensable technical feature, do not belong to same inventive concept.

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Therefore, these claims are not in conformity with the prescription of unity according to Article 31(1) of Chinese Patent Law.

20. Based on the amendments to Claims, the applicant shall make corresponding amendments to Description.

The applicant should amend the present application to overcome all the defects on the basis of the opinions raised in this Office Action. Otherwise, the present application will be rejected. The applicant should amend the independent Claim 1 and state the reasons that the amended Claim 1 possesses novelty and inventiveness compared with the reference documents. The applicant should note that any amendments should not go beyond the scope of the original Description and Claims according to Article 33 of Chinese Patent Law.